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(71) Applicant: **UNITED TECHNOLOGIES AUTOMOTIVE, Inc.**
Dearborn, MI 48126-9982 (US)

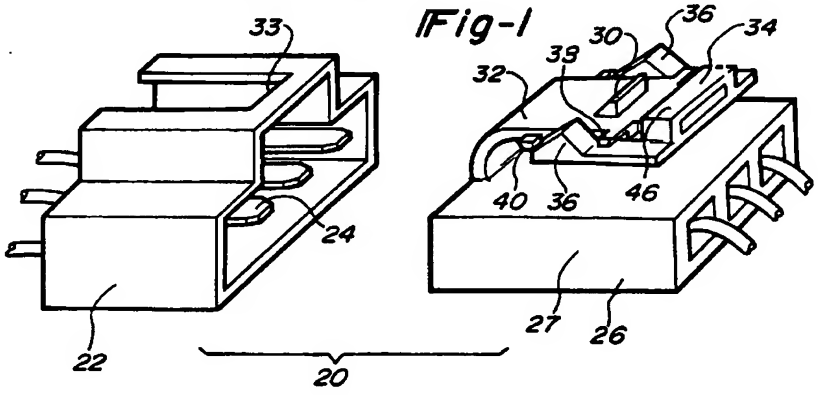
(72) Inventors:
- **Childs, Christopher John**
  Rochester Hills, Michigan 48307 (US)
- **Hood, Brian M.**
  Clinton Township, Michigan 48036 (US)

(74) Representative: **Gilding, Martin John et al**
Eric Potter & Clarkson
St. Mary's Court
St. Mary's Gate
Nottingham NG1 1LE (GB)

(54) Connector latch interlock plate

(57) An interlock plate is received on an electrical connector which includes a latch to be received in a channel on a mating electrical connector. The plate is selectively movable between locked and unlocked positions, and prevents movement of the latch outwardly of the channel when in the locked position. The electrical connection is made by connecting the two electrical connectors, with the latch moving into the channel. During this initial connection, the plate is received on the electrical connector in the unlocked position. The plate is then moved to the locked position, where it remains while the electrical connection is maintained. At that position, abutments on the plate and the connector prevent movement of the latch outwardly of the channel. Should it be desired to disconnect the electrical connection, the plate is initially moved back to its unlocked position, and the connectors may then be separated. The plate is configured such that it will force the latch into the channel when moved to the locked position should the latch not be fully received within the channel. In addition, the plate prevents connection of the first and second electrical connectors when in the locked position. Finally, structure on the electrical connector and plate insures that the plate is securely retained on the electrical connector during assembly and shipment.

Fig-1



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Description

BACKGROUND OF THE INVENTION

This invention relates to an interlock plate which prevents the latch of an electrical connector from moving out of its mating channel while the electrical connection is made.

Electrical connections in modem vehicle environments are typically made with plug-in connections to facilitate speed and accuracy of the connections. While such connections have gained wide success, some problems do exist in that the connections have sometimes become disconnected. To that end, the prior art has included various features which attempt to prevent disconnection of the connectors.

In one prior art example, an electrical connection is often made by providing one of the two electrical connector with a latch that extends upwardly into a channel in the other of the electrical connectors. The latch is biased into the channel when the two connectors are mapped together, and the electrical connection between the two connectors is made at a location remote from the latch and channel. The latch and channel connection maintains the connectors fully connected. Some problems exist with this type of electrical connection, since the latch is typically biased into the channel by a relatively small force. Thus, should something come into contact with the latch, it may easily move outwardly of the channel, allowing the electrical connection to become unconnected. The small bias force is desirable to facilitate assembly, but possible disconnection is an undesirable result. In tact, disconnection of latch-type electrical connectors due to movement of the latch outwardly of the channel is one of the greatest complaints with latch-type electrical connections.

To address the problem of latch movement, the prior art has attempted to place various devices onto the connectors to hold the latch in the locked position. These devices have not been fully successful, as they have sometimes complicated the connection of the electrical connectors, or unduly increased the required insertion force.

One other major problem in the prior art is the partial connection of the electrical connectors, with the latch only partially received in the channel, and consequently only partial electrical connections between the electrical connectors. The prior art has also not successfully addressed this problem.

SUMMARY OF INVENTION

In a disclosed embodiment of this invention, an interlock plate is received on the latch of an electrical connector. The interlock plate is movable relative to the latch between locked and unlocked positions. When the interlock plate is in the locked position, it prevents movement of the latch downwardly out of the channel. Once the electrical connection is made, and the latch is received in the channel, the interlock plate is moved to the locked position. The latch can no longer be accidentally moved outwardly of the channel. Rather, the interlock plate must be moved back to the unlocked position before the latch will be able to be moved outwardly of the channel for disconnection. Further, movement of the interlock plate to the locked position forces the latch into the channel, avoiding partial connection of the connectors.

In a preferred embodiment of this invention, the interlock plate is separate from the remainder of the latch, and slides along a tongue on the electrical connector which includes the latch. The interlock plate includes a guide channel slidable on the tongue between the unlocked and locked positions. In further features of this invention, the tongue which carries the latch includes two stops, and the interlock plate includes an arm with an ear that is positioned between the two stops in the unlocked position. The interlock plate is moved beyond the stops when in the locked position.

An abutment on an underside of the interlock plate is aligned with a mating abutment on a first connector when the interlock plate is in the locked position. The aligned abutments prevent the interlock plate; the tongue, and hence the latch, from being moved downwardly while the interlock plate is in the locked position. The same aligned abutments force the latch of a partially connected connector into the channel, assuring complete connection.

In the unlocked position, the abutment on the interlock plate is spaced from the abutment on the connector. The interlock plate and tongue may then move downwardly such that the latch may move outwardly of the channel. At the same time, since the ear on the interlock plate is received between the two stops on the tongue, the interlock plate is securely retained on the tongue such that it is not lost during assembly or shipment. In other features of this invention, the ears, abutments and stops have appropriately ramped surfaces to facilitate the movement of the ear and the remainder of the interlock plate between the locked and unlocked positions.

In a method according to the present invention, a first connector element is initially assembled by placing the interlock plate on a tongue associated with the first connector, and which also carries the latch. The interlock plate is initially placed in an unlocked position with the ear received between two stops on the tongue. The first connector element is then connected to a second connector element, with the latch moving into a channel in the second connector. Electrical connections on the first and second connector elements are assured and maintained when the two connector elements are in a position with the latch fully received in the channel. After the electrical connection is made, the interlock plate is moved to the locked position. Abutment members on the interlock plate and the first connector element prevent the latch from being moved outwardly of the channel. Should it be desired to disconnect the electrical connection, the interlock plate is first moved back to the unlocked position.

The latch can then be moved outwardly of the channel, and the two connectors disconnected.

These and other features and objects of the present invention can be best understood from the following specification and drawings, of which the following is a brief description.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is an assembly view of an electrical connection according to the present invention.

Figure 2 is a perspective view of a portion of one connector according to the present invention.

Figure 3 is a view similar to Figure 2, but showing a subsequent step in the assembly of the connector.

Figure 4 is a view similar to Figure 3, but showing yet another subsequent step in the assembly.

Figure 5 is a view similar to Figure 4, but showing yet another subsequent step.

Figure 6 is a cross-sectional view through the electrical connection shown in Figure 1, with one of the connectors in the position approximately as shown in Figure 3.

Figure 7 is a cross-sectional view similar to that shown in Figure 6, but showing the one connector having moved to the position shown in Figure 5.

DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

An electrical connection 20 includes a first connector 22 with electrical connection elements 24 and a second connector 26, having electrical connections which mate with connections 24, as is known. The electrical connector 26 includes a body 27 including a latch 30 formed on a tongue 32. Latch 30 is received within a channel 33 on connector 22 to maintain the connectors 22 and 26 connected. The latch and channel connection is known in the prior art, and experiences problems as described above. To address the problems, an interlock plate 34 is provided, which includes ears 36 received between stop members 38 and 40 to secure interlock plate 34 on tongue 32.

As shown in Figure 2, tongue 32 includes a guide portion 42 forwardly of latch 30, which extends within a guide channel 44 in interlock plate 34. A top surface 46 of interlock plate 34 provides a large push surface for disconnecting latch 30 from channel 33, as will be explained below. Ears 36 include a ramped forward surface 48 and a ramped rear surface 50, which facilitate movement of ears 36 relative to stops 38 and 40. Stops 38 and 40 are formed with respective ramped surfaces 52 and 54, also to facilitate relative movement of ears 36. Ear 50 is connected to the body 49 of interlock plate 34 through an arm 51.

As shown in Figure 3, interlock plate 34 is now received on tongue 32 in an unlocked position, as will be described below. To reach this position, ears 36 are biased downwardly, and surface 48 moves along ramp surface 52 to facilitate sliding movement of ear 36 beyond stop 38. Ear 36 is then released, and moves upwardly towards its relaxed position between stop 38 and stop 40. The ear is securely retained between the stops 38 and 40, but with arm 51 in a relaxed position. Thus, interlock plate 34 remains on tongue during shipment of the connector 26.

As shown in Figure 4, interlock plate 34 is now being moved towards the locked position. Interlock plate 34 is slid along guide surface 42, with ear 36 biased downwardly to move behind stop 40.

As shown in Figure 5, ear 36 is now positioned behind stop 40, with ramp surface 50 contacting ramp surface 54. Again, the ear is securely held in this position, but with arm 51 in a relaxed condition. The two ramped surfaces facilitate disconnection and movement of the interlock plate 34 back to a unlocked position, as will be explained below.

As shown in Figure 6, latch 30 is received within channel 33. An electrical connection between the connection element is assured while the latch is maintained in the channel. Interlock plate 34 is in the unlocked position shown in Figure 3. As shown, an abutment 56 having a ramped surface 57 is formed on an undersurface of interlock plate 34. A second abutment 58 having an opposed ramped surface 59 is formed on body 27. Abutments 56 and 58 are not aligned in this unlocked position. Should an assembler wish to disconnect latch 30 from channel 33 while interlock plate 34 is in this unlocked position, then latch 30 may be simply moved downwardly by pressing downwardly on any portion of tongue 32. Top surface 46 of interlock plate 34 provides a convenient and comfortable surface for depressing the tongue 32, and consequently latch 30, vertically downwardly as shown in Figure 6 to allow disconnection of connectors 22 and 26.

Interlock plate 34 is shown in the locked position in Figure 7. Abutments 56 and 58 are aligned. In this position, should a force, accidental or otherwise, tend to move latch 30 downwardly out of channel 33, abutment 56 will hit abutment 58. Further downward movement will be prevented. Thus, latch 30 may not move outwardly of channel 33, and the connection between electrical connector members 22 and 26 will remain.

The ramped surfaces 57 and 59 on the respective abutment 56 and 58 insure that the plate 34 may be easily moved between the unlocked and locked positions, even when latch 30 is not fully received in channel 33. One major problem with prior electrical connectors is a so-called "partial" connection. In such a partial connection, while the latch 30 may be partially received in channel 33, it is not fully received in channel 33. Assemblers sometimes have difficulty assuring full or complete connection. With interlock plate 34, movement of the plate 34 between the unlocked position to the locked position will force latch 33 to its fully connected position in channel 33. If the latch 30 is not fully received within channel 33, then tongue 32, and consequently interlock plate 34 will be biased slightly downwardly from the position

shown in Figure 6. In such a position, when the interlock plate 34 is moved to the left in the Figure 6, the ramp surface 57 of abutment 56 will come into contact with ramp surface 59 of abutment 58. Further leftward movement of the interlock plate 34 will cause the abutment 56, and consequently interlock plate 34, to be guided vertically upwardly. This movement would in turn cause tongue 32, and consequently latch 30, to also be brought upwardly, with latch 30 being moved fully into channel 33. Once interlock plate 34 reaches the fully locked position as shown in Figure 7, the abutments 56 and 58 have assured that latch 30 is fully received within channel 33.

Another feature of the present invention is that latch 30 cannot move into channel 33 if one attempts to connect electrical connectors 22 and 26 while interlock plate 34 is in the locked position as shown in Figure 7. In this position, latch 30 cannot be biased downwardly, and thus it cannot move under the portion 59 of connector 22 to be received within channel 33. This feature insures that the interlock plate 34 is in the unlocked position when the electrical connectors 22 and 26 are connected, and that the interlock plate 34 is then moved to the locked position once the latch 30 is received in channel 33.

In a method of assembling an electrical connection according to this invention, interlock plate 34 is initially placed on the guide surface 42 of the tongue 32 of a first connector 26. Interlock plate 34 is positioned at the unlocked position as shown in Figure 3, where it is retained on the guide surface. The electrical connection is then made by moving latch 30 into the channel 33, and making an electrical connection between the connection members 24 on connector 22 and the mating connections in connector 27. At that time, the connection would resemble the arrangement as shown in Figure 6. Interlock plate 34 is then moved to the locked position as shown in Figure 7. In this position, latch 30 cannot move outwardly of channel 33, and the electrical connection will be maintained.

Should it be desired to disconnect the electrical connection between electrical connectors 22 and 26, then ears 33 are initially biased downwardly, with ramp surfaces 50 sliding along ramp surface 54. The interlock plate 34 is then brought to the right as shown in Figure 7, until ears 36 can move back upwardly between stops 38 and 40. At that time, the members have moved back to the unlocked position as shown in Figure 6. Latch 30 may then be biased downwardly out of channel 33, and the electrical connection may be disconnected. Top surface 46 is positioned on an opposite side of the portion 61 of connector 22 which forms the front end of channel 33. As described above, top surface 46 facilitates movement of latch 30.

A preferred embodiment of this invention has been disclosed, however, a worker of ordinary skill in the art would recognize that certain modifications would come within the scope of this invention. For that reason, the following claims should be studied to determine the true scope and content of this invention.

Claims

1. An electrical connection comprising:

   a first electrical connector, comprising at least one electrical connection element, and a channel to receive a latch from a second electrical connector;

   a second electrical connector, said second electrical connector having at least one electrical connection element for mating with said electrical connection elements on said first electrical connector, said second electrical connector also having a latch to be selectively biased into said channel to secure said first and second electrical connectors; and

   means to selectively prevent movement of said latch out of said channel and maintain the connection between said first and second connectors, said means to prevent movement being selectively moveable between locked and unlocked positions, and said means to prevent movement, ensuring said latch is in said channel when moved to said locked position.

2. An electrical connection as recited in Claim 1, wherein said means to prevent movement includes a member which is movable on said second connector, and which is separate from both said first and second connectors.

3. An electrical connection as recited in Claim 2, wherein said latch is formed on a tongue extending away from the remainder of said second electrical connector, said means to prevent being a plate which is slidable along said tongue between said locked and unlocked positions.

4. An electrical connection as recited in Claim 3, wherein a pair of stops are formed at distinct axial positions along said tongue, and said plate including at least one ear which is selectively positioned between said stops to place said plate in a first of said locked and unlocked positions, and beyond both of said stops when said plate is in a second of said locked and unlocked positions.

5. An electrical connection as recited in Claim 4, wherein said stops and said ear have ramped surfaces to facilitate movement of said ear relative to said stops.

6. An electrical connection as recited in Claim 5, wherein a forwardmost one of said stops has a ramped surface on a forward facing end, and a rearwardmost of said stops has a ramp surface on a rearwardmost end, said ear having ramp surfaces on both forward and rearward facing surfaces, with said forward facing ramp surface on said ear facilitating movement of said ear along said ramp surface of

said forwardmost stop, and said rearward ramp surface of said ear facilitating movement of said ear relative to said rearwardmost stop.

7. An electrical connection as recited in Claim 4, wherein said plate has an abutment which is aligned with an abutment member on said second connector member when said plate is in said locked position, to prevent said latch from moving outwardly of said channel, with said abutment on said plate contacting said abutment on said second connector, preventing movement of said latch outwardly of said channel, said abutments not being aligned when said plate is in said unlocked position, such that said latch may move outwardly of said channel.

8. An electrical connection as recited in Claim 1, wherein said means to prevent movement is a sea-rate plate having an abutment member which is aligned with an abutment member on said second connector when said interlock plate is in said locked position, to prevent said latch from moving outwardly of said channel, with said abutment on said interlock plate contacting said abutment on said second connector, preventing movement of said latch outwardly of said channel, said abutments not being aligned when said interlock plate is in said unlocked position, such that said latch may move outwardly of said channel.

9. An electrical connection as recited in Claim 1, wherein said means to prevent movement is a plate including a guide channel which is slidable on a guide surface which also carries said latch, said plate including a top surface positioned outwardly of said guide surface.

10. An electrical connection as recited in Claim 9, wherein said top surface being positioned relative to said latch, on an opposed side of a portion of said first connector which forms said channel such that by depressing said top surface of said interlock plate, said tongue, and consequently said latch may move outwardly of said channel to allow disconnection of said first and second connectors.

11. An electrical connector comprising:

an electrical connector body having at least one electrical connection for mating contact with another electrical connector, said electrical connector body carrying a latch which is to be selectively biased into a channel on the other electrical connector; and

means to selectively prevent movement of said latch out of the channel in the other connector member, and maintain a connection between said one electrical connector and the other electrical connector, said means to prevent movement being a separate plate which is selectively moveable relative to said one electrical connector between locked and unlocked positions, and said plate ensuring said latch is in a position such that it will be fully received in a channel, when said plate is in said locked position.

12. An electrical connector as recited in Claim 11, wherein said latch is formed on a tongue extending away from said body of said one electrical connector, said plate being slidable along said tongue between said locked and unlocked positions.

13. An electrical connector as recited in Claim 11, wherein said plate includes a guide channel which is slidable on a guide surface of said body of said one electrical connector member which also carries said latch, said plate including a top surface positioned outwardly of said guide surface, said top surface providing a surface that may be depressed to consequently depress said tongue and move said latch outwardly of the channel which is to receive said latch.

14. An electrical connection as recited in Claim 11, wherein said plate has an abutment member which is selectively aligned with an abutment member on said body of said one electrical connector member when said plate is in said locked position, said abutment members being non-aligned when said plate is in said unlocked position.

15. An electrical connection as recited in Claim 8 or Claim 14, wherein said abutments having mating ramped surfaces and said abutment ramped surfaces facilitating movement of said plate to said locked position when said latch is not fully received in said channel.

16. An electrical connection comprising:

a first electrical connector, comprising at least one electrical connection element, and a channel to receive a latch from a second electrical connector;

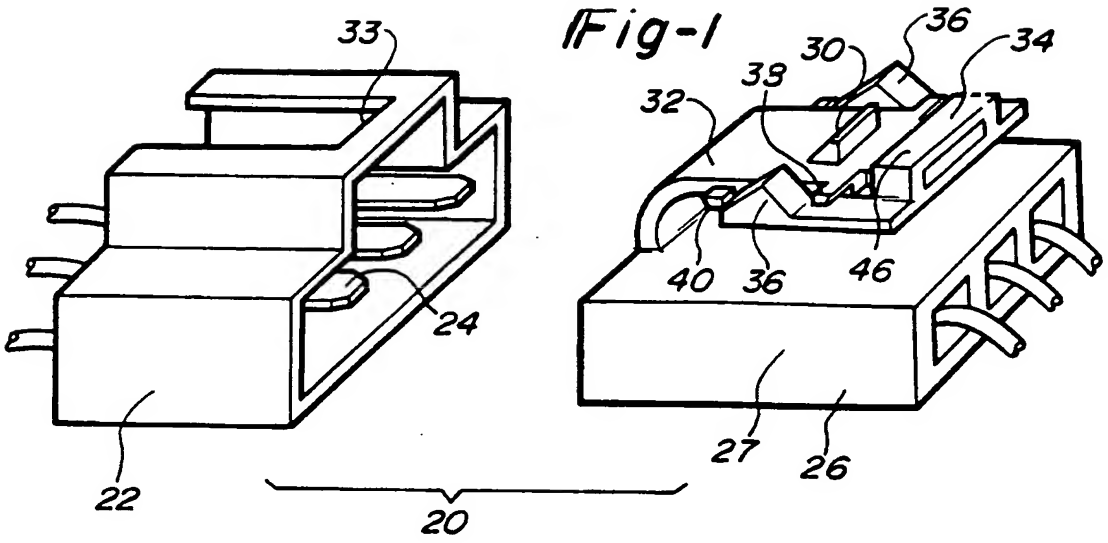
a second electrical connector, said second electrical connector having at least one electrical connection element for mating with said electrical connection elements on said first electrical connector, said second electrical connector having a latch to be selectively biased into said channel to secure said first and second electrical connectors; and

means to selectively prevent movement of said latch out of said channel and maintain the connection between said first and second connectors, said means to prevent movement being selectively moveable between locked and unlocked positions, and said means to prevent movement being securely retained on said second electrical connector when in said unlocked position.

17. An electrical connection as recited in Claim 16, wherein said means to prevent movement is a plate slidable along a tongue on said electrical connector, said tongue also being formed with said latch, said tongue being formed with a pair of stops at distinct axial positions, and said plate including at least one ear selectively positioned between said stops to place said plate in a first of said locked and unlocked positions, and beyond both of said stops when said plate is in a second of said locked and unlocked positions.

18. An electrical connection as recited in Claim 5 or Claim 17, wherein said ear is positioned beyond both of said stops when said plate is in said locked position.

Fig-1



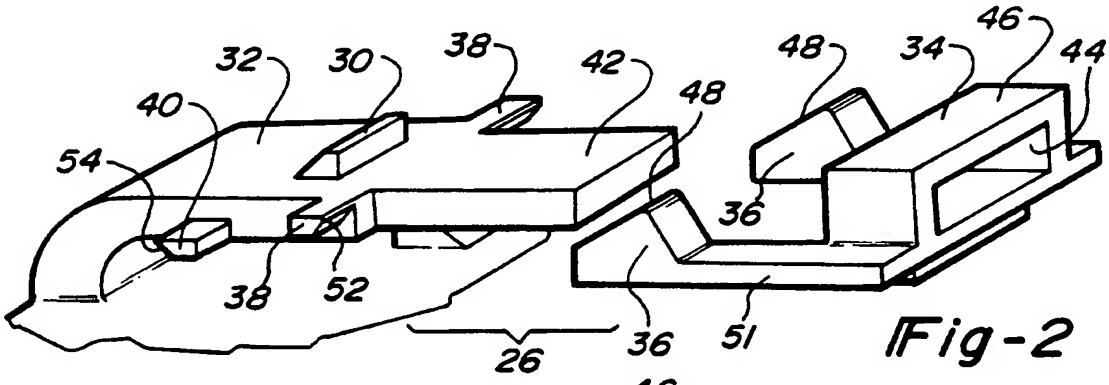


Fig-2

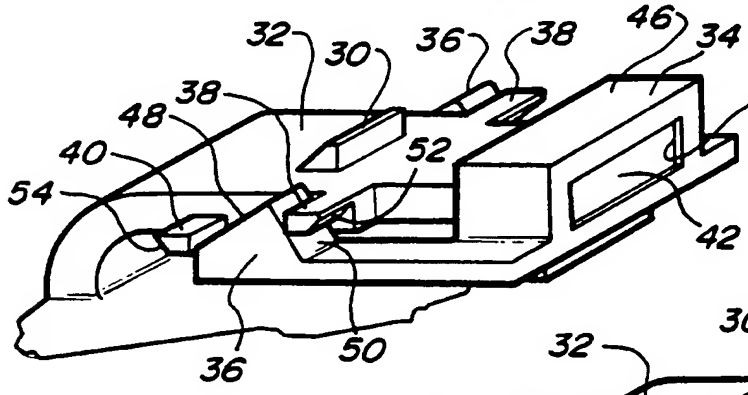


Fig-3

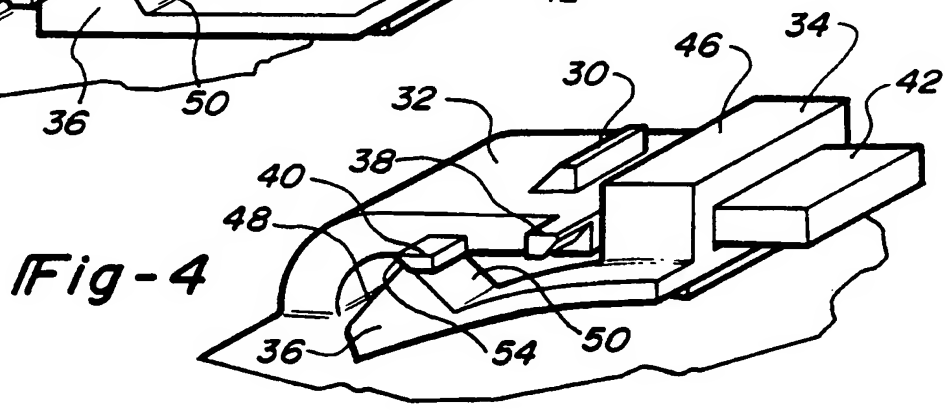


Fig-4

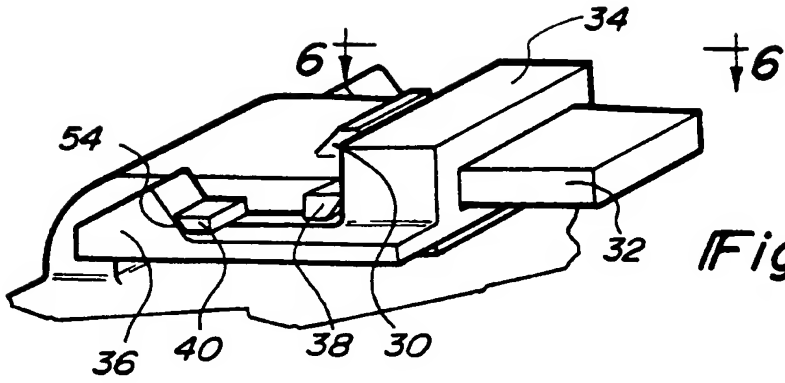


Fig-5

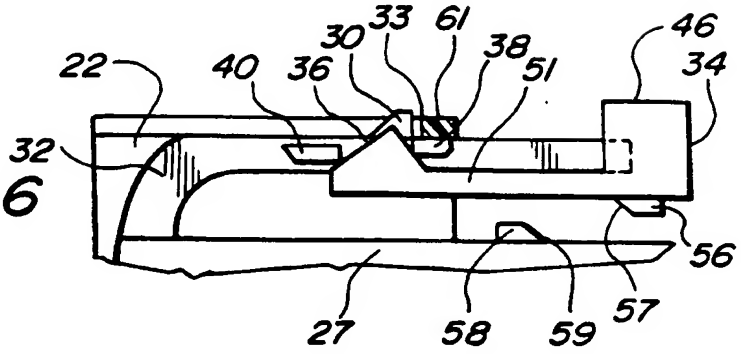


Fig-6

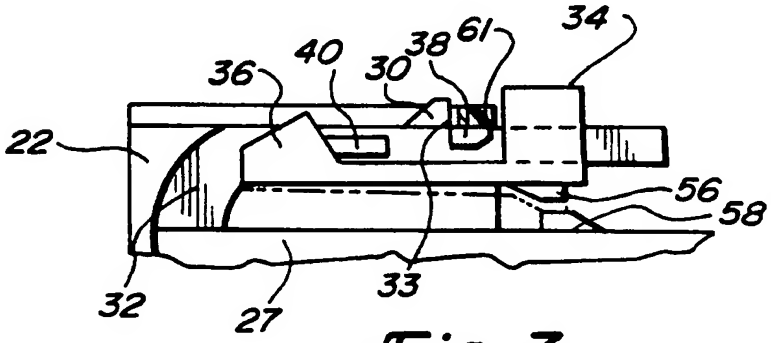


Fig-7